DOCUMENT RESUME

ED 305 839 HE 022 373

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TITLE	Alternate Approaches to Teaching Medical Technology: The Simulated Laboratory.
PUB DATE	Feb 89
NOTE	35p.; Paper presented at the Annual Meeting of the Eastern Educational Research Association (Savannah, GA, February 22-25, 1989).
PUB TYPE	Speeches/Conference Papers (150) -- Reports - Descriptive (141)
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	Affiliated Schools; Allied Health Personnel; Associate Degrees; Community Colleges; Field Experience Programs; *Laboratories; Laboratory Technology; *Medical Technologists; Program Evaluation; *Simulated Environment; Simulation; Teaching Methods; Two Year Colleges
IDENTIFIERS	*Hudson Valley Community College NY

ABSTRACT

An evaluation of a non-traditional, self-contained Medical Laboratory Technology (MLT) program at Hudson Valley Community College is presented. This community based associate degree program has used simulated laboratories for 26 years and is seeking initial accreditation through a national accrediting agency. Until recently allied health programs in MLT were traditional programs designed with the clinical practice component affiliated with hospitals. Current change in health care delivery systems and reduced enrollments in the health science fields have caused many affiliate institutions to reassess their laboratory programs. The minimum standards necessary for accreditation of the Hudson Valley program and examples of the requirements are discussed. Evaluation issues include how well the MLT program compares with the standards set forth in the "Essentials and Guidelines of an Accredited Education Program for the Medical Laboratory Technician" and how well it achieves its stated goals (successful employment as entry level medical laboratory technicians and transfer into baccalaureate degree programs). The process evaluation results indicate: (1) overall, all graduates met or exceeded expectations as a career entry medical technician and (2) transfer into Medical Technology programs remain the most successful transfer agreement. The Hudson Valley Community College MLT program is comparable or superior to other traditional programs utilizing affiliate settings. (SM)

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ALTERNATE APPROACHES TO TEACHING MEDICAL TECHNOLOGY: THE SIMULATED LABORATORY

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February 1989

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ABSTRACT

The focus of this presentation is the evaluation of a non-traditional, self-contained Medical Laboratory Technology Program. This community college based, associate degree program has used simulated laboratories for twenty-six years. The results show that this program is comparable or superior to other traditional programs utilizing affiliate settings.

ALTERNATE APPROACHES TO TEACHING MEDICAL TECHNOLOGY: THE SIMULATED LABORATORY

Until recently allied health programs in Medical Laboratory Technology were traditional programs designed with the clinical practice component affiliated with hospitals. Current and imminent change in health care delivery systems has caused many affiliate institutions to reassess their laboratory programs. Reduced enrollments in the health science fields including Medical Laboratory Technology have put financial strains on educational institutions and affiliates to the point where some programs have been deactivated.

As a consequence, many institutions are developing programs that are self-contained and do not have affiliated clinical practicums. This study is an evaluation of a non-traditional program at Hudson Valley Community College in Troy, New York. This program has been in existence for twenty-six years and is seeking initial accreditation through a national accrediting agency.

Description of the Program

The Biology Department of the School of Health Science has developed a Medical Laboratory Technology Curriculum and is authorized by the New York State Education Department to grant an Associate in Applied Science Degree (AAS) in Medical Laboratory Technology. At the time of the program

development (1962) similar programs were generally affiliated with hospitals to facilitate the clinical practice. Since there was only limited space available in the local hospitals, the new program used a simulated laboratory approach in lieu of the hospital clinical experience. Since that time the program has continued to maintain simulated laboratories as a means of training students.

A definition of the simulated laboratory is best described by the setting and materials. Within the college laboratory environs, the laboratory sessions structured as a clinical affiliate training facility would function. Prototypes of automated and semi-automated equipment are available; specimen collection (where appropriate), specimen handling, and scope and range of specimens reflect those typically handled in an affiliate setting. Currently the curriculum includes six simulated laboratories: Pathogenic Microbiology, Urinalysis, Hematology, Immunology/Immunohematology, Instrumental Analysis and Biochemistry. A seventh laboratory is under development and Instrumental Analysis and Biochemistry will be changed during the next academic year.

The MLT program has two major goals.

1. To prepare students for successful employmment after the two year MLT program .

2. To provide maximum opportunity for continuation towards a baccalaureate degree program in Medical Technology or related areas.

Background of the Study

The Medical Laboratory Program is currently seeking national accreditation through the National Accrediting Agency For Clinical Laboratory Sciences (NAACLS). NAACLS, in cooperation with the Committee on Allied Health Education and Accreditation (CAHEA) accredites medical laboratory technician programs sponsored by both private and public sector institutions. As part of this process, NAACLS has issued Essentials and Guidelines of an Accreditated Education Program for the Medical Laboratory Technician. This document presents the minimum standards necessary for accreditation and examples of the requirements.

Focus of the Evaluation : Evaluation Issues

While the Biology Department has conducted periodic program reviews, these reviews have not compared the existing program to the minimum standards presented in the Essentials and Guidelines of an Accreditated Education Program for the Medical Laboratory Technician. The Department recognizes the need to focus on these apriori standards; thus, this initial evaluation will focus on:

I. How well does the MLT program compare with the standards set forth in the Essentials for An Accredited Educational Program for the Medical Laboratory Technician? Does the college based program simulated laboratory setting offer the laboratory experiences required of affiliated settings?

II. How well does the MLT program achieve its stated goals? That is, are the graduates prepared for: 1) successful employment as entry level Medical Technicians, and 2) transfer into baccalaureate degree programs?

Evaluation Design

During the academic year from January 1988 through April 1988, process and product evaluations of the Medical Laboratory Technology Program were conducted. A summary of the methodologies used for each is presented below.

Process Evaluation

The process evaluation focused on one area: the assessment of how well the clinical component of the HVCC program simulates the clinical laboratory science components in an affiliate setting. According to the Essentials, simulated laboratory settings must reflect directed practice similar to the clinical environment with respect to volume

and variety of tests and equipment. The Essentials refers to this type of program design as a "self-contained" program. Further, the Essentials require that the "self-contained" program clearly describe how the "real life" aspects of a clinical Laboratory are simulated.

Process Methodology

Qualitative and ethnographic methodologies were utilized to address the first question. This included analysis of the records of the community college clinical laboratories in two courses, Pathogenic Microbiology and Hematology. Variables used for comparison were: range and scope of specimens, clinical materials and equipment. These records were compared with those of a clinical hospital facility that serves as an affiliate setting for a Medical Technology Program (baccalaureate degree).

It was decided to make the comparison with the School of Medical Technology at St. Peter's Hospital because of a long standing relationship between the programs. The Advisory Board over the twenty-six year history of the college program has had members from the St. Peter's program. Their experience in accreditation was another factor. Many of the Hudson Valley graduates are recruited by the hospital. In addition, a number of the Hudson Valley graduates transferring to baccalaureate degree programs have completed their internship year at the School of Medical Technology.

Associate degree programs were considered. The only associate degree program with simulated laboratories in the state was located a considerable distance from Hudson Valley. This program is serving as an advisor to the Hudson Valley program during the initial accreditation process. Other associate degree programs were examined for their rotation schedules and program structure.

The clinical laboratory at the School of Medical Technology at St. Peter's Hospital is part of a program accredited through NAACLS. The School of Medical Technology is in the process of deactivation due to lack of enrollment and excessive operational costs.

Results

Pathogenic Microbiology. The Pathogenic Microbiology Laboratory at the college is held over a fifteen week semester. Clinical material is obtained from the hospital, college volunteers, or prepared in the laboratory. Faculty and support staff have developed formulae for clinical specimens that mimic actual specimens. In addition to the traditional specimens, students work with cultures used in conjunction with a Computer Assisted Instruction program.

A system of automation of microbiological testing is in the present budget. Up to this time, a fully automated system was not practical.

A modified comparison of the hospital setting and the community college is abbreviated below:

MICROBIOLOGY LABORATORY	HVCC	SPH
Number of weeks	15	9
Hours per meeting	4	6
Meetings per week	2	5
Range of stock culture organisms (Genera)	34	40
Major rapid identification reagents	6	3
Automated systems	No	Yes

While a greater number of clinical specimens are encountered at the hospital setting, the variety handled in each laboratory are the essentially the same. At St. Peter's Hospital students encounter automation during a one week rotation in the main laboratory. The acquisition of automated equipment at HVCC will provide greater comparison between the settings.

Hematology. Hudson Valley's Hematology course is designed to fit into the traditional fifteen week schedule. Clinical specimens are obtained through area hospitals, American National Red Cross, and volunteers. An extensive collection of stained microscopic slides of normal and disease states

have been obtained through area hospitals. The hospital affiliation course is a daily rotation for twelve weeks. Table 1 estimates the number of clinical specimens handled by a student during the twelve week rotation. A comparison of the analyses performed by students in each institution shows that the scope of tests are essentially the same. The number of analyses vary with the Hudson Valley course numbers significantly lower. It must be pointed out that if the HVCC program did use an affiliate laboratory, the rotation would likely be 2 to 4 weeks long due to constraints in scheduling. As a result, the number of specimens handled by each student based upon the reduction in rotation (1/3) would approach the number of specimens in the college laboratory.

The course coordinator in the student Hematology laboratory at the hospital indicated that she believes that the ranges of specimens from HVCC (Table 2) compare to the range of specimens at St. Peter's Hospital.

Conclusion of Process Evaluation

The process evaluation showed the following results. <u>To what extent does the college based program simualted laboratory setting offer the laboratory experiences comparable to the affiliate setting?</u> The scope and range of specimens in both Hematology and Microbiology appear comparable. At the present time there is a major constraint in the school based program in the areas of maintaining an

adequate supply of clinical material and equipment. If hospitals decide not to release clinical material for transport to the college a major problem could result. In Microbiology at Hudson Valley, the system of simulating clinical specimens and volunteer sources will support the program's goals. On the surface, it seems that the Essentials will also be met adequately. In Hematology some tests would be difficult to obtain from volunteer sources but not impossible. (Fetal hemoglobin, Coagulation specimens)

It is obvious that all of the state of the art large equipment presently available in many hospitals today will not be accessible to students in the college based laboratory. Such equipment would be an impractical purchase as the volume of tests would not support its use. Smaller units and prototypes should continue to be used in the laboratories and an effort should be made to incorporate demonstration of large scale equipment by vendors or through visitation to a clinical facility.

Product Evaluation

Quantitive methodologies were used to answer the second question and a product evaluation model was chosen. To assess how well the school prepared graduates for immediate work at entry level positions, questionnaires were sent to employers of all 1987 graduates. Seven of the nine employers (78%) responded to the survey. The second phase

examined the graduates' self-assessment of their preparation for employment and/or transfer. This questionnaire was sent to all 1986 and 1987 graduates. The overall response rate by the graduates was 61%. A Likert type scale was used for both instruments.

Product Methodology and Results of Surveys

Two separate survey instruments were developed for the product evaluation. A brief description of the instrument and the results follow below:

Employer Survey. The employer survey was designed to obtain information on the extent to which students had been prepared for initial employment. The Essentials and Guidelines requires that competencies of graduates be described in detail for cognitive (including problem solving and decision making), attitudinal (affective), and technical (performance/psychomotor) characteristics. Questions on the survey incorporated these characteristics. The instrument included additional demographic information, assessment of departmental references, and space for employer's suggestions for courses, program or workshops. Tables 3 through 5 are appended and elaborate on the questions addressed.

According to departmental records, nine of the thirteen graduates of 1987 were employed. In the area of cognitive skills (Table 3) employers uniformly rated the graduates as

having an average to excellent knowledge of test procedures (100%). All graduates were rated average to excellent in their knowledge of the operation of instruments and understanding and use of quality control procedures. Where problem solving skills were required, respondents rated the graduates as having met or exceeded (58%) that which is expected of employees in entry level positions. One graduate was rated unacceptable.

Table 4 shows the affective characteristics such as cooperation with supervisors and job attitude and interest. All graduates were rated average to excellent. In cooperation with peers, one graduate was rated unacceptable. Eighty-six percent were rated excellent in dependability. Accepting responsibility and constructive criticism showed one instance each (14%) ranked unacceptable with the remainder average or excellent. Finally, in those graduates exposed to new procedures, all were average or excellent in response.

Table 5 lists the results of the assessment of technical skills. The goal of the program is to graduate technicians that will enter the job market and will proceed to perform laboratory analyses with minimal supervision during a designated probationary period. Eighty-six percent of the graduates were able to meet or exceed average expectations in the area of performance of routine tasks with minimal supervision. One graduate was unacceptable. All graduates involved in performing complex procedures were

rated average or excellent. Likewise, those who were responsible for the preparation of laboratory records and computer entry and retrieval of data were categorized average to excellent in these abilities. All graduates were accountable for accurate results in the average or excellent range. Two graduates did not perform acceptable under pressure; all remaining graduates were average or excellent in response to pressure situations. On the overall preparation for the initial job, two were ranked average (29%0, four excellent (57%), and one (14%) unacceptable.

Information obtained in the employer instrument correlated well with the faculty assessment of the students taken prior to graduation.

Graduate Survey. The graduate survey incorporated information similar to that found in the employer survey. Additional information surveyed included demographic data, whether the student entered the program as a transfer student and whether the student was enrolled on a part time or full time basis. Activities since leaving the college regarding employment and/or continuing education were also included. Students were also asked to assess how well they were prepared for initial employment. This information provided a basis for comparison between employers and graduates.

The graduate surveys were sent to the thirteen graduates of the class of 1987 and the eighteen 1986

graduates. Nine of the thirteen 1987 graduates (69%) and ten of the eighteen 1986 graduates (56%) responded to the survey.

Tables 6 through 8 summarize the results of the graduate survey in the cognitive, affective, and technical areas. Nineteen responded to these areas on the instrument.

The area of cognitive skills are listed in Table 6. Eighty-nine percent feel that their preparation in knowledge of test procedures was average or excellent. This does not differ substantially from the employer rating in this area. Sixteen percent felt that their preparation in the operation of instruments was unacceptable. Review of employment information indicates that those responding unacceptable are employed in areas where the technician is likely to encounter sophisticated equipment not presently available in student laboratories. Eighty-four percent rated problem solving skills average or excellent. Seventy-four percent felt that the training was acceptable in the area of quality control while 16% ranked this area unacceptable. Overall, the graduates and employer response shows that the graduates feel that their problem solving skills are greater than those observed by the employers. In the remaining areas, both rated cognitive skills usually meeting acceptable levels.

In the affective areas of the survey (Table 7) all respondents ranking these areas rated themselves average to excellent in the majority. Three areas, cooperation with

supervisors, job attitude and interest, and accepts constructive criticism were cited as unacceptable at 16%, 5%, and 16% respectively. Employers tended to rank the affective characteristics higher than the graduates.

In the last group of skills, the technical area (Table 8) indicates graduate dissatisfaction in preparation of laboratory records (21%) and computer use (47%). Employers did not identify these areas as weaknesses. Graduates expect to perform complex tasks; 84% felt they were prepared. Five percent felt preparation for complex tasks was unacceptable. All remaining areas indicate average to excellent preparation.

In the overall assessment of preparation for employment, the seventeen individuals working in the field all agreed that their preparation was average (35%) and 65% excellent.

To a great extent employers and graduates tended to view the skill in all three areas similiarly.

Table 9 identifies the graduates assessment of preparation for continuining education in four areas: 1) preparation for transfer, 2) critical thinking/problem solving, 3) technical skills, 4) writing skills. Combined with other information, the data indicates above average to excellent transfer to Medical Technology and Food and Nutrition B.S. programs. One transfer to a Biology program indicates above average to excellent while the other rates

the transfer below average. Overall, 80% rated preparation for transfer average or above.

In the area of critical thinking/problem solving skills, 13% indicated below average preparation. The remaining 87% ranking their skills average through excellent.

Sixty percent of the respondents perceived their ability to transfer technical as excellent, the remaining 40% rated it above average or average.

Writing skills were determined to be the area of weakness with 7% excellent ranking, 13% below average and 80% average or above average.

Conclusions of Product Evaluation

The results of the process evaluation are abbreviated below:

<u>To what extent are the graduates prepared for successful employment</u>? Overall, all graduates met or exceeded expectations as a career entry Medical Technician. The diversity of job categories and responsibilities indicates that the program is capable of giving the core information and skills required to enter at entry level positions. Employers felt that the information sought through the Biology Department was helpful and reliable.

<u>To what extent does the curriculum provide courses that prepare the students for transfer into baccalaureate degree</u>

programs? Transfer into Medical Technology programs remain the most successful transfer agreement. Overall successful transfer to baccalaureate programs remains strong.

Implications

The impact of a changing health care system may result in a lack of affiliate training facilities. As the demand for trained laboratory technicians increases, educational institutions will need to think about bringing clinical training to their institutions. While present accreditation standards are reflective of the traditional setting, educational institutions designing innovative non-traditional programs can proceed without compromising the standards. Carefully researched simulated laboratories can provide an educational experience that is comparable or superior to traditional programs utilizing affiliated settings.

TABLE 1

COMBINED HEMATOLOGY SPECIMEN ESTIMATES - SPH/HVCC

ANALYSES	Number SPH 12 week	SPH 4 week	HVCC
RED BLOOD COUNT			
manual	50	13	11
semi-automated	50	13	14
WHITE BLOOD COUNT			
manual	50	13	20
semi-automated	50	13	14
HEMOGLOBIN			
manual	60	20	50
semi-automated	120	40	14
HEMATOCRIT	120	40	37
PLATELET COUNT			
manual	24	8	7
semi-automated	24	8	11
RETICULOCYTE COUNT	10	3	7
EOSINOPHIL COUNT	10	3	7
CSF CELL COUNT AND DIFFERENTIAL	5	2	9
ERYTHROCYTE SEDIMENTATION RATE	6	2	6
PROTIME			
manual	28	9	0
semi-automated	19	6	8
PTT			
manual	19	6	8
FIBRINOGEN	2	2	0
THROMBIN	2	2	0
FETAL HEMOGLOBIN	0	0	2
WBC DIFFERENTIALS	50	20	33

TABLE 2

HEMATOLOGY SPECIMEN RANGES

RBC: 1.9 X 106 - 7.00 X 106

WBC: 3.2 X 10^3 - 21.0 X 10^3

HGB: 5.5 G/DL - 24.0 G/DL

RETICULOCYTE COUNT: 0.0% - 7.4%

EOSINOPHIL COUNT: 30 - 700 MM^3

PROTIME: 10.0 - 83.0 SEC.

PTT: 23.0 - > 150 SEC.

ESR: 0 - 35 MM/HR.

PLATELET COUNT : 50.0 - 550 X 10^3

FETAL HEMOGLOBIN DETERMINATION : 0 - 1.1 %

CSF CELL COUNT : NORMAL TO GROSSLY BLOODY, ALSO XANTHROCHROMIC FLUIDS AND WBC 0 - 700 MM^3

TABLE 3

ESTIMATE OF EMPLOYERS ASSESSMENT OF
PRE-PREPARATION FOR EMPLOYMENT
COGNITIVE SKILLS
N = 7

Dimensions rated and question number	Unacceptable %	Average %	Excellent %	Not Applicable %
4. Knowledge of test procedure	0	43	57	0
5. Operation of instruments	0	57 *	29	14
6. Problem solving	14	29	29	29
7. Understanding and use of quality control procedures	0	43	43	14

* One qualified response - small instruments only.

TABLE 4

ESTIMATE OF EMPLOYERS ASSESSMENT OF
PRE-PREPARATION FOR EMPLOYMENT
AFFECTIVE CHARACTERISTICS

N = 7

Dimensions rated and question number	Unacceptable %	Average %	Excellent %	Not Applicable %
9. Cooperation with supervisors	0	29	71	0
10. Cooperation with peers	14	14	71	0
11. Job attitude and interest	0	29	71	0
12. Dependability	0 *	0 *	86	0
13. Accepts responsibility	14	14	71	0
16. Accepts constructive criticism	14	29	57	0
17. Interest in learning new procedures	0	43	43	14

* one qualified response - could not judge between unacceptable and acceptable

TABLE 5

ESTIMATE OF EMPLOYER ASSESSMENT OF
PRE-PREPARATION FOR EMPLOYMENT
TECHNICAL SKILLS

N = 7

Dimensions rated and question number	Unacceptable %	Average %	Excellent %	Not Applicable %
1. Performs routine tasks with minimal supervision	14	29	57	0
2. Performs complex tasks with minimal supervision	0	14	43	43
3. Accountable for accurate results	0	43	57	0
8. Preparation of lab records	0	43	14	43
18. Performs under pressure	29	29	43	0
19. Computer use	0	43	29	29

TABLE 6

GRADUATE SELF-ASSESSMENT OF
PRE-PREPARATION FOR EMPLOYMENT
COGNITIVE SKILLS

N = 19

Dimensions rated and question number	Unacceptable %	Average %	Excellent %	Not Applicable %
4. Knowledge of test procedure	0	50 *	39 *	11 *
5. Operation of instruments	16	26	47	11
6. Problem solving	5	47	37	11
7. Understanding and use of quality control procedures	16	32	42	11

* this question was omitted on one survey

TABLE 7

GRADUATE SELF-ASSESSMENT OF
PRE-PREPARATION FOR EMPLOYMENT
AFFECTIVE CHARACTERISTICS

N = 19

Dimensions rated and question number	Unacceptable %	Average %	Excellent %	Not Applicable %
9. Cooperation with supervisors	16	16	47	21
10. Cooperation with peers	0	26	53	21
11. Job attitude and interest	5	32	42	21
12. Dependability	0	26	53	21
13. Accepts responsibility	0	26	63	11
16. Accepts constructive criticism	16	21	47	16
17. Interest in learning new procedures	0	37	53	11

TABLE 8

GRADUATE SELF- ASSESSMENT OF
PRE-PREPARATION FOR EMPLOYMENT
TECHNICAL SKILLS

N = 19

Dimensions rated and question number	Unacceptable %	Average %	Excellent %	Not Applicable %
1. Performs routine tasks with minimal supervision	0	26	68	5
2. Performs complex tasks with minimal supervision	5	47	37	11
3. Accountable for accurate results	0	32	58	11
8. Preparation of lab records	21	37	32	11
18. Performs under pressure	0	32	53	16
19. Computer use	47	21	16	16

TABLE 9

GRADUATE ASSESSMENT OF PREPARATION
FOR CONTINUING EDUCATION

N = 15

Dimensions measured	Excellent %	Above Average %	Average %	Below Average %
Preparation for transfer	33	27	20	20
Critical thinking/problem solving	33	27	27	13
Technical skills	60	20	20	0
Writing skills	7	47	33	13